IN THE CLAIMS:

Please amend Claims 1 and 4 as follows.

1. (Currently Amended) A method of detecting a predetermined mark embedded in an image, said mark comprising a predetermined arrangement of a plurality of elements, said elements having a predetermined colour characteristic, the method comprising the steps of:

processing the image to provide an encoded representation of the image at a predetermined resolution, said encoded representation being adapted to emphasize the elements of the mark based on the predetermined color characteristics of the elements;

detecting a location of each of said elements of the mark embedded in the image from the encoded representation;

applying a mask having a predefined annular region to said mark to convert those detected element locations that fall within said annular region into a set of spatial features representing an angular distribution of the detected elements of said mark;

comparing the ~~determined~~ converted set of spatial features to a known set of spatial features to provide a confidence level measure representing a correlation error between the spatial features of the known set and the determined set of spatial features; and

detecting said predetermined mark on the basis of said confidence level measure.

2. (Cancelled)

3. (Previously Presented) The method of claim 1, wherein the features indicating said angular distribution comprise a signature indicating a discrete angular distribution about a predetermined origin for each mark.

4. (Currently Amended) Apparatus for detecting a predetermined mark embedded in an image, said mark comprising a predetermined arrangement of a plurality of elements, said elements having a predetermined colour characteristic, the apparatus comprising:

processing means for processing the image to provide an encoded representation of the image at a predetermined resolution, said encoded representation being adapted to emphasize the elements of the mark based on the predetermined color characteristics of the elements;

detecting means for detecting a location of each of said elements of the mark embedded in the image from the encoded representation;

conversion means for applying a mask having a predefined annular region to said mark to convert those detected element locations that fall within said annular region into a set of spatial features representing a an angular distribution of the detected elements of said mark;

comparison means for comparing the ~~determined~~ converted set of spatial features to a known set of spatial features so as to provide a confidence level measure, and outputting the confidence level measure representing a correlation error between the spatial features of the known set and the determined set of spatial features; and

mark detection means for detecting said predetermined mark on the basis of said confidence level measure.

5. (Cancelled)

6. (Previously Presented) Apparatus according to claim 4, wherein the features indicating said angular distribution comprise a signature indicating a discrete angular distribution about a predetermined origin for each mark.

7. (Original) Apparatus according to claim 6, wherein the signature comprises a plurality of radial signatures, each said radial signature indicating a discrete angular distribution of each element in a predetermined annular region encircling said origin.

8. (Previously Presented) Apparatus according to claim 6, wherein said comparison means compares a signature of the determined spatial feature with a corresponding signature of a known mark.

9. (Previously Presented) A computer program product including a computer readable medium having recorded thereon a computer program for detecting a predetermined mark embedded in an image, said mark comprising a predetermined arrangement of a plurality of elements, said elements having a predetermined colour characteristic, the computer program product comprising:

processing means for processing the image to provide an encoded representation of the image at a predetermined resolution, said encoded representation being adapted to emphasize the elements of the mark based on the predetermined color characteristics of the elements;

detecting means for detecting a location of each of said elements of the mark embedded in the image from the encoded representation;

conversion means for applying a mask having a predefined annular region to said mark to convert those detected element locations that fall within said annular region into a set of spatial features representing a an annular distribution of the detected elements of said mark;

comparison means for comparing the determined set of spatial features and a known set of spatial features so as to provide a confidence level measure, and outputting the confidence level measure representing a correlation error between the spatial features of the known set and the determined set of spatial features; and

mark detection means for detecting the predetermined mark on the basis of said confidence level measure.

10. (Cancelled)

11. (Previously Presented) A computer program product according to claim 9, wherein the features indicating said angular distribution comprises a signature indicating a discrete angular distribution about a predetermined origin for each mark.

12. (Original) A computer program product according to claim 11, wherein the signature comprises a plurality of radial signatures, each said radial signature indicating a discrete angular distribution of each element in a predetermined annular region encircling said origin.

13. (Original) A computer program product according to claim 11, wherein said comparison means compares a signature of the determined spatial feature with a corresponding signature of a known mark.

14. - 43. (Cancelled)

44. (Previously Presented) Apparatus for detecting a predetermined mark embedded in an image, said mark comprising a predetermined arrangement of a plurality of elements, each element having a predetermined colour characteristic and predetermined shape, the apparatus comprising:

processing means for processing the image to provide an encoded representation of the image at a predetermined resolution;

detecting means for detecting coordinate positions of substantially each of said elements of the mark embedded in the image, wherein the detection is characterised by applying at least one mask to substantially each pixel of the encoded representation;

spatial feature determining means for determining a plurality of radial signatures, each said radial signature indicating a discrete angular distribution of each element in about a predetermined origin;

comparison means for comparing the determined set of spatial features to a known set of spatial features and outputting a confidence level measure representing a correlation error between the spatial features of the known set and the determined set of spatial features; and

mark detecting means for detecting said predetermined mark on the basis of said confidence level measure.

45. (Previously Presented) A computer program product including a computer readable medium having recorded thereon a computer program for detecting a predetermined mark embedded in an image, said mark comprising a predetermined arrangement of a plurality of elements, each element having a predetermined colour characteristic and predetermined shape, the computer program product comprising:

processing means for processing the image to provide an encoded representation of the image at a predetermined resolution;

detecting means for detecting coordinate positions of substantially each of said elements of the mark embedded in the image, wherein the detection is characterised by applying at least one mask to substantially each pixel of the encoded representation;

spatial feature determining means for determining a plurality of radial signatures, each said radial signature indicating a discrete angular distribution of each element in about a predetermined origin;

comparison means for comparing the determined set of spatial features to a known set of spatial features and outputting a confidence level measure representing a correlation error between the spatial features of the known set and the determined set of spatial features; and

mark detection means for detecting said predetermined mark on the basis of said confidence level.

46. (Previously Presented) Apparatus according to claim 4, wherein said image data comprising a plurality of pixels, each said pixel being represented using multiple colour channels, said apparatus comprising:

pixel buffer pipe means, having an input means for receiving said image data in a predetermined order and for detecting transitions between foreground and background pixels;

a pixel selection means for subsampling said image data in a first direction in accordance with an intensity of one said colour channel of the image data to provide a first desired resolution in said first direction;

foreground density checking means for receiving said one colour channel and outputting;

a) if an intensity value of one said colour channel is below a first predetermined threshold value, a first token;

b) if the intensity value of said one colour channel is above a second predetermined threshold value, a second token; or

c) if the intensity value of said one colour channel is intermediate the first and second threshold values:

ca) the first token when a transition is detected at the pixel buffer pipe means; and

cb) the second token when a transition is not detected at the pixel buffer pipe means;

encoding means for receiving at least one other of said colour channels and selectively grouping each pixel represented in said at least one other colour channel into one group of a plurality foreground colour groups if the output of said foreground density checking means is the first token and grouping into a background colour group if the output of said foreground density checking means is the second token, said encoding means outputting for each pixel a representation of the corresponding group; and

output buffer means for receiving said representation and providing a subsampling in a second direction of the image data to achieve a second desired resolution in said second direction.

47. (Previously Presented) Apparatus according to claim 46, wherein further comprising subsample control means for further subsampling in said second direction according to a magnification value and an input resolution value.

48. (Previously Presented) Apparatus according to claim 47, wherein said transition is determined by the pixel buffer pipe means using lead pixels and lag pixels.

49. (Previously Presented) Apparatus according to claim 48, wherein said predetermined order comprises a raster scan order.

50. (Previously Presented) Apparatus according to claim 49, wherein said transition is a transition from background pixel to foreground pixel.

51. (Previously Presented) Apparatus according claim 50, wherein said first and second desired resolutions are substantially the same resolution.

52. (Previously Presented) A method according to claim 1, wherein said image data comprises a plurality of pixels, each said pixel being represented using multiple colour channels, the method comprising the steps of;

inputting pixels in a predetermined order and detecting transitions between foreground and background pixels;

subsampling in a first direction of the image data in accordance with an intensity of one said colour channel of the image data to provide a first desired resolution in said first direction;

examining said one colour channel and outputting:

a) if an intensity value of said one colour channel is below a first predetermined threshold value, a first token;

b) if the intensity value of said one colour channel is above a second predetermined threshold value, a second token; or

c) if the intensity value is intermediate the first and second threshold values:

ca) the first token when a transition is detected upon inputting said pixels; and

cb) the second token when a transition is not detected upon inputting said pixels;

encoding each said pixel by selectively grouping each said pixel represented in at least one other of said colour channels into one group of a plurality foreground colour groups if said examining step outputs a first token and grouping into a background colour group if said examining step outputs a second token, and outputting for each pixel a representation of the corresponding group; and

subsampling in a second direction of the image data to achieve a second desired resolution in said second direction.

53. (Previously Presented) A method according to claim 52, wherein said transition is determined using lead pixels and lag pixels.

54. (Previously Presented) A method according to claim 53, wherein said foreground pixel is a pixel having colour value belonging to a predetermined set colour values and the background pixel is a pixel which is not a foreground pixel.

55. (Previously Presented) A method according to claim 54, wherein said predetermined order is raster scan order.

56. (Previously Presented) A method according to claim 55, wherein said transition is a transition from background pixel to foreground pixel.

57. (Previously Presented) A method according to claim 55, wherein said transition is a transition from a foreground pixel to a background pixel.

58. (Previously Presented) A computer program product according to claim 9, wherein said image data comprises a plurality of pixels, each pixel being represented using multiple colour channels, the computer program product comprising;

pixel buffer pipe means, having an input means for receiving said image data in a predetermined order and for detecting transitions between foreground and background pixels;

pixel selection means for subsampling said image data in a first direction in accordance with an intensity of one said colour channel of the image data to provide a first desired resolution in said first direction;

foreground density examining means for receiving said one colour channel and outputting:

a) if an intensity value of said one colour channel is below a first predetermined threshold value, a first token;

b) if the intensity value of said one colour channel is above a second predetermined threshold value, a second token; or

c) if the intensity value of said one colour channel is intermediate the first and second threshold values;

ca) the first token when a transition is detected at the pixel buffer pipe means; and

cb) the second token when a transition is not detected at the pixel buffer pipe means;

encoding means for receiving at least one other of said colour channels and selectively grouping each pixel represented in said at least one other colour channel into one group of a plurality foreground colour groups if the output of said foreground density examining means is a first token and grouping into a background colour group if the output of said foreground density checking means is a second token, said encoding means outputting for each pixel a representation of the corresponding group; and

output buffer means for receiving said representation and providing a subsampling in a second direction of the image data to achieve a second desired resolution in said second direction.

59. (Previously Presented) A computer program product according to claim 58, wherein said transition is determined by the pixel buffer pipe means using lead pixels and lag pixels.

60. (Previously Presented) A computer program product according to claim 59, wherein said first and second desired resolutions are substantially the same resolution.

61. (Previously Presented) Apparatus according to claim 4, wherein said image comprising a plurality of pixels, each said pixel being encoded either as a foreground or background pixel, said predetermined pattern being intended to substantially match a predetermined reference pattern, the reference pattern being represented by a mask arranged as a two dimensional array of cells, the cells having indicated thereon whether the reference pattern comprises foreground pixels, background pixels or neither, said apparatus comprising:

input means for receiving a plurality of one dimensional arrays of pixel values of said image, wherein each said array being received sequentially;

foreground adder means for generating a plurality of partial sums of said foreground pixels, for each array of pixel values, intended to match with the reference pattern of the mask, wherein each partial sum of said foreground pixels substantially corresponds to an application of a slice of said mask;

background adder means for generating a plurality of partial sums of said background pixels, for each array of pixel values, intended to match with the reference pattern of the mask, wherein each partial sum of said background pixels substantially corresponds to the application to the application of said slice;

a foreground accumulator network for providing a total foreground count value of said plurality of partial sums for a predetermined number of input arrays of pixel values;

a background accumulator network for providing a total background count value of said plurality of partial sums for the predetermined number of input arrays of pixel values;

thresholding means for thresholding the total foreground count value and the total background count value against first and second predetermined threshold values respectively and outputting a value reflecting each threshold comparison; and

determining means for determining from each output value whether or not the predetermined pattern is detected.

62. (Previously Presented) Apparatus according to claim 61, wherein said image comprises a plurality of scan lines, each said scan line having a plurality of pixel values and said one dimensional array comprises a predetermined number of pixel values of corresponding locations on a plurality of adjacent scan lines.

63 (Previously Presented) Apparatus according to claim 61, wherein said apparatus forms a pipeline circuit for pipelining the sequences of one dimensional arrays.

64. (Previously Presented) A method according to claim 1, wherein said image comprises a plurality of pixels, each said pixel being encoded either as foreground or background pixel, said predetermined pattern substantially matching a predetermined reference pattern, the reference pattern being representable by a mask arranged as a two dimensional array of cells, each cell having indicated thereon whether the cell is a foreground pixel, background pixel or neither, the method comprising the steps of:

providing a plurality of one dimensional arrays of pixel values of said image, wherein each array is provided sequence;

generating a plurality of partial sums of foreground pixels for a current one dimensional array of pixel values which match with foreground cells of the reference pattern of a slice of the mask;

generating a plurality of partial sums of background pixels for the current one dimensional array of pixel values which match with background cells of the reference pattern of said slice of the mask;

accumulating the partial sums of foreground pixels for a predetermined number of input one dimensional arrays of pixel values to provide a total foreground count value;

accumulating the partial sums of background pixels for a predetermined number of input one dimensional arrays of pixel values to provide a total background count value;

thresholding the total foreground count value and the total background count value against a first and second predetermined threshold value respectively and outputting a value reflecting each threshold comparison; and

determining from each output value whether or not the predetermined pattern is detected.

65. (Previously Presented) A method according to claim 64, wherein said foreground pixels are pixels having one colour selected from a first set of colour values and said background pixels are pixels having one colour selected from a second predetermined set of colour values.

66. (Previously Presented) A method according to claim 65, wherein each cell of the slice of the mask corresponds with a pixel value of the one dimensional array.

67. (Previously Presented) A method according to claim 1, wherein said image comprises a plurality of pixels, each said pixel being either on or off, said predetermined pattern substantially matching a predetermined reference pattern, the reference pattern being representable by a mask arranged as a two dimensional array of cells, each cell having indicated thereon whether the cell is on or off, the method comprising the steps of:

providing a plurality of one dimensional arrays of pixel values of said image, wherein each array is provided sequence;

generating a plurality of partial sums of on pixel values for a current one dimensional array of pixel values which match with an on cell of the reference pattern of a slice of the mask;

accumulating the partial sums for a predetermined number of input one dimensional arrays of pixel values; and

thresholding the accumulated partial sums against a predetermined threshold value and determining whether or not the predetermined patten is detected based on the threshold comparison.

68. (Previously Presented) A computer program product according to claim 9, wherein said image comprises a plurality of pixels, each said pixel being encoded either as a foreground or background pixel, said predetermined pattern substantially matching a predetermined reference pattern, the reference patten being represented by a mask arranged as two dimensional array of cells, the cells having indicated thereon whether the reference patten is foreground pixel, background pixel or neither, the computer program product comprising:

input means for receiving a plurality of one dimensional arrays of pixel values of said image, wherein each array is received sequentially;

foreground adder means for generating a plurality of partial sums of foreground pixels, for each array of pixel values, which match with the reference pattern of the mask, wherein each partial sum substantially corresponds to an application of a slice of said mask;

background adder means for generating a plurality of partial sums of background pixels, for each array of pixel values, which match with the reference pattern of the mask, wherein each partial sum of background pixels substantially corresponds to the application of said slice;

a foreground accumulator network for providing a total foreground count value of said plurality of partial sums for a predetermined number of input arrays of pixel values;

a background accumulator network for providing a total background count value of said plurality of partial sums for the predetermined number of input arrays of pixel values;

thresholding means for thresholding the total foreground count value and the total background count value against a first and second predetermined threshold value respectively and outputting a value reflecting each threshold comparison; and

determining means for determining from each output value whether or not the predetermined pattern is detected.

69. (Previously Presented) A computer program product according to claim 68, wherein said image comprise a plurality of scan lines, each scan line having a plurality of pixel values and said one dimensional array comprises a predetermined number of pixel values of corresponding locations on a plurality of adjacent scan lines.

70. (Previously Presented) A computer program product according to claim 69, wherein said foreground pixels are pixels having one colour selected from a first set of colour values and said background pixels are pixels having one colour selected from a second predetermined set of colour values.

71. (Previously Presented) A method according to Claim 1 wherein said encoded representation is at a reduced resolution when compared to the image.

72. (Previously Presented) Apparatus according to Claim 4 wherein said encoded representation is at a reduced resolution when compared to the image.

73. (Previously Presented) A computer program product according to Claim 9 wherein said encoded representation is at a reduced resolution when compared to the image.

74. (Previously Presented) A method according to Claim 1 wherein said mask is a signature mask and said method further comprises applying a zero detect mask to said mark to detect whether or not a mark element center location is coincident with one of a group of cells of the zero detect mask associated with said annular region.

75. (Previously Presented) A method according to Claim 74 wherein said signature mask and said zero detect mask are unitarily formed.

76. (Previously Presented) A method according to Claim 74 wherein said group of cells complements said annular region.

77. (Previously Presented) Apparatus according to Claim 4 wherein said mask is a signature mask and said apparatus further comprises means for applying a zero detect mask to said mark to detect whether or not a mark element center location is coincident with one of a group of cells of the zero detect mask associated with said annular region.

78. (Previously Presented) A computer program product according to Claim 9 wherein said mask is a signature mask and said computer program product further comprises means for applying a zero detect mask to said mark to detect whether or not a mark element center location is coincident with one of a group of cells of the zero detect mask associated with said annular region.